Themed Issue: Challenges and Issues in Veterinary Pharmacology and Animal Health
Guest Editors - Marilyn Martinez and Stefan Soback

Postexposure Management and Treatment of Anthrax in Dogs—Executive Councils of the American Academy of Veterinary Pharmacology and Therapeutics and the American College of Veterinary Clinical Pharmacology

Submitted: September 23, 2004; Accepted: September 27, 2004; Published: September 22, 2005

Cory Langston[1]

[1]Animal Health Center, College of Veterinary Medicine, Mississippi State University, Mississippi State, MS 39762-6100

ABSTRACT

Dogs are generally at low risk of developing disease following exposure to anthrax. When disease does occur, it appears associated with oral exposure to the bacteria leading to massive swelling of the head, neck, and mediastinal regions. Death is due to toxemia and shock. For animals at high risk, such as search and rescue dogs with a known exposure, doxycycline at 5 mg/kg orally once daily for 45 to 60 days is suggested as a prophylactic treatment. Additional information on the diagnosis, prevention, and treatment of the disease in dogs is presented.

KEYWORDS: anthrax, dog, prevention, treatment, bioterrorism

POSTEXPOSURE MANAGEMENT AND TREATMENT OF ANTHRAX IN DOGS

As anthrax is not communicable, pets are likely to be incidental victims of a bioterrorism attack with this organism. Also, carnivores seem quite resistant to infection and therefore large-scale preventive treatment of pets would seldom be warranted. Dogs have nevertheless been known to contract the disease, usually through ingestion of meat from animals having died of anthrax. It is noteworthy that the respiratory tract does not appear to be a primary route of infection in the dog. Though this route of exposure was suggested in one case of naturally occurring canine anthrax, this was in part because no source of carrion could be found to otherwise explain the infection.[1] In a disease model in which 14 dogs were exposed to clouds of anthrax spores, only 3 animals became febrile, and none developed the actual disease.[2] Cutaneous anthrax has not been reported in animals, although entry of the organism through a skin lesion cannot be discounted. The American Academy of Veterinary Pharmacology and Therapeutics (AAVPT) and the American College of Veterinary Clinical Pharmacology (ACVCP) nevertheless realize that concerns exist about proper management of guide dogs, police dogs, and search and rescue dogs that may have become exposed to anthrax. Accordingly, the following information on the disease, its prevention, and treatment in dogs is offered.[3]

Anthrax appears to enter the body of the dog through the oropharynx and upper gastrointestinal (GI) tract. Therefore, regional lymph nodes of these areas are most commonly affected, and massive swelling of the head, neck, and mediastinal regions are the most frequent signs.[4,5] Death often is due to toxemia and shock, though asphyxia can play a role. Hemorrhagic gastroenteritis has also been reported in a dog that also had ptyalism and a swollen foreleg.[2]

Antemortem diagnosis of anthrax is based on probable exposure, clinical signs, and demonstration of the organism in blood, lymph node or tissue aspirates, or pharyngeal swabs. It is important to note that anthrax spores survive nearly all cytological staining techniques, including the brief heat fixing used in Gram staining. Definitive diagnosis is based on culture of the organism. Animals that die of suspected anthrax will usually be septicemic, such that a blood sample will reveal the organism cytologically and by culture. Necropsy of an anthrax suspect is not advised as exposure to air rapidly causes sporulation of the vegetative bacteria. If an animal has however already been opened for postmortem evaluation, a sample of spleen, lymph nodes, intestine, lung, liver, bronchial lymph nodes, tonsil, and pharynx should be collected. Anthrax is a reportable disease in all species. Contaminated areas should be treated with a sporicidal disinfectant such as a 1:10 dilution of household bleach (final solution containing 0.5% sodium hypochlorite; allow 60 minutes of contact).[6]

As with any bacterial infection, treatment of anthrax is based on the susceptibility of the organism to available antibiotics. While alteration of the bacteria to resist common antibiotics is a concern for "weaponized" anthrax, the anthrax associated with the autumn of 2001 terrorist attack appears to have an antimicrobial susceptibility pattern similar to endemic anthrax found within the United States. As such, if

Corresponding Author: Cory Langston, Animal Health Center, College of Veterinary Medicine, Mississippi State University, PO Box 6100, Mississippi State, MS 39762-6100. Tel: (662) 325-3432; Fax: (662) 325-4011; E-mail: langston@cvm.msstate.edu

a pet is considered exposed to *Bacillus anthracis* (the causative organism of the disease anthrax), the AAVPT and the ACVCP recommend prophylactic treatment with doxycycline at 5 mg/kg orally every 24 hours. In animals for which doxycycline cannot be administered (eg, pregnant animals or young animals in which teeth staining is an issue), amoxicillin at 20 mg/kg orally every 12 hours may be substituted. The required duration of prophylactic drug administration is unknown but should probably mimic that used in humans of 45 to 60 days. Unless new evidence suggests resistance to these antibiotics or introduction of a new strain of unknown susceptibility, the fluoroquinolones should not be used prophylactically. Such use will only promote general bacterial resistance to this valuable family of antibiotics. Furthermore, there is no evidence to suggest that fluoroquinolones are more efficacious than either the tetracyclines or penicillins for susceptible anthrax. If a pet is exposed to anthrax, care to decontaminate the fur to avoid transmission to humans is advised. Since no present disinfectants that kill spores are safe for use on living animals, repeated bathing is recommended to mechanically remove the organism.

Treatment of clinical anthrax must be early and aggressive with parenteral therapy usually warranted initially. Any of 3 antibiotic regimens may be considered. These include the following:

- Oxytetracycline 5 mg/kg IV every 24 hours
- Potassium penicillin G at 20 000 U/kg IV every 8 hours (Note: The likelihood of beta-lactamase induction, which would increase the minimum inhibitory concentration [MIC] of the organism to penicillin, is significantly higher for anthrax disease as opposed to postexposure prophylaxis. Penicillin G should be used only when other agents are contraindicated.)
- Enrofloxacin 5 mg/kg every 24 hours

There is no evidence to suggest which, if any, regimen provides the best outcome. In addition to antibiotic therapy, supportive therapy is warranted. (Oral therapy may be substituted for parenteral therapy if the animal survives the acute disease.) A tracheostomy may be required if edema in the pharyngeal region is severe. Pleural effusions may also need to be removed. If intestinal anthrax is suspected, oral therapy may be used to supplement parenteral therapy, provided the animal can swallow.

References

1. McGee ED, Fritz DL, Ezzell JW, Newcomb HL, Brown RJ, Jaax NK. Anthrax in a dog. *Vet Pathol.* 1994;31:471-473.

2. Gleiser CA, Gochenour WS Jr, Ward MK. Pulmonary lesions in dogs and pigs exposed to a cloud of anthrax spores. *J Comp Pathol*. 1968;78:445-448.

3. Cornell Feline Health Center. Veterinary Information Brief: Responding to Concerns about Anthrax in Domestic Cats. Available at: http://web.vet.cornell.edu/public/fhc/anthrax.html. Accessed January 2004.

4. Davies ME, Hodgman SFJ, Skulski G. An outbreak of anthrax in a hound kennel. *Vet Rec.* 1957;17:775-776.

5. Timoney JF. The genus *Bacillus*. In: Timoney JF, Hagan WA, eds. *Hagan and Bruner's Microbiology and Infectious Diseases of Domestic Animals.* 8th ed. Ithaca, NY: Cornell University Press; 1988:206-211.

6. EPA Office of Pesticide Programs. Emergency Use of Bleach in Anthrax Decontamination. Available at: http://www.epa.gov/pesticides/factsheets/chemicals/bleachfactsheet.htm. Accessed January 2004.